



X-eHealth

Exchanging Electronic Health Records
in a common framework

Overview

Jürgen Brandstätter

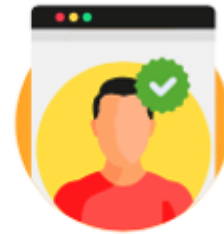
What is x-eHealth project?



Citizens' secure access
to their health data,
also across borders



Personalised medicine
through shared European
data infrastructure



Citizen empowerment
with digital tools for user feedback
and person-centred care

Project Scope

X-eHealth's purpose is to develop the foundations for a common framework for **medical imaging, discharge letters, laboratory orders and results and rare diseases** to flow both alongside citizens care pathway and across health entities between EU Member States and neighbour countries.



Medical Imaging



Discharge Letters



Laboratory Results



Rare Diseases

Key facts

- **European Commission funded project**
 - 36 consortium partners
 - 5 collaborative partners
 - 6 eHealth skilled experts
 - Policy and political actors mixed with national competent authorities
- **Webpage**
 - <https://www.x-ehealth.eu/>
- **Project schedule: 2 years**
 - Start: September 2020
 - End: End of August 2022
- **X-eHealth „nature“**
 - Between a (public health) policy intervention and a research project

About to be extended
until end of Nov 2022!

Project objectives

- Contribute to **the Digital Single Market Strategy** of the European Commission
- Lay the foundations to **advance the integration process of the eHealth services** features into the already in place European Cross Border Patient Summary
 - eHealth Digital Service Infrastructure (eHDSI)
- The key goals are to:
 - Improve the healthcare quality and safety for citizens by allowing them to **access** and manage **their electronic health record from any place in the EU**;
 - **Contribute to standardisation and harmonisation** of eHealth services in the EU by setting European agreements on diverse levels of interoperability;
 - **Contribute to defragmentation** of European services;
 - **Facilitate interaction** between patients and healthcare providers, to support prevention and citizen empowerment.

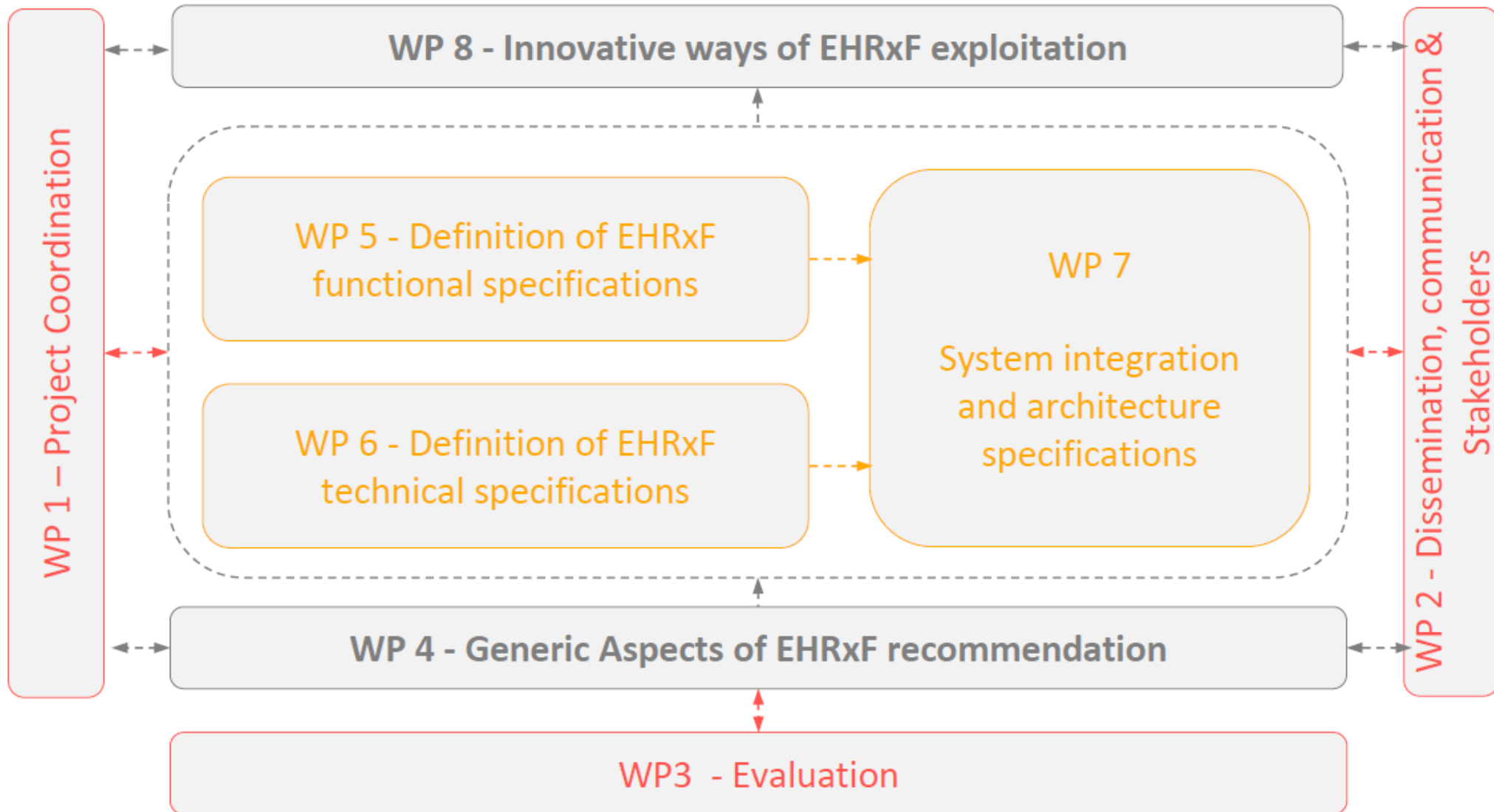
European Health Data Space

Specific objectives

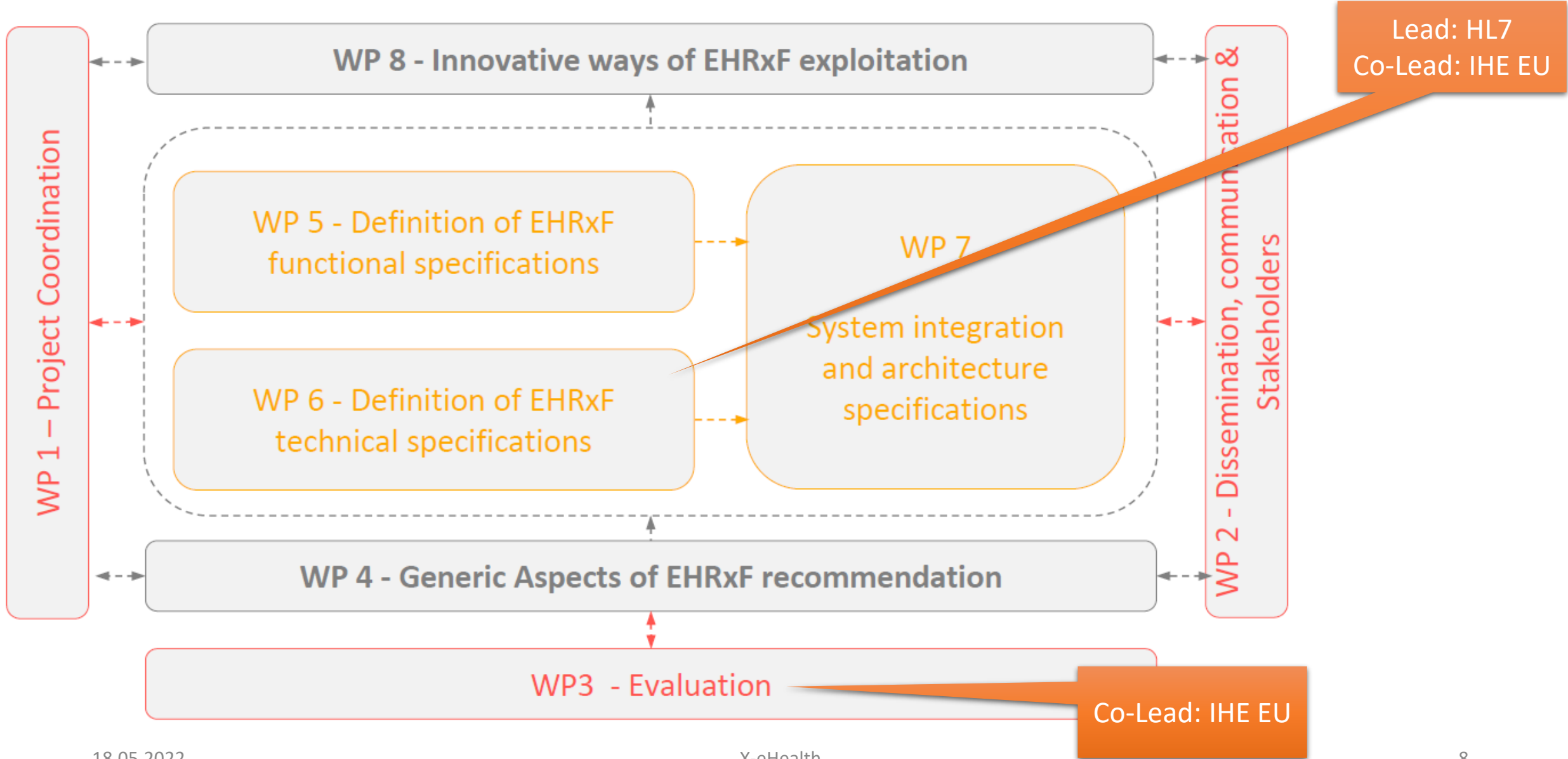
- To **reach a common understanding** in the EU on the efforts needed to adopt the commonly defined EEHRxF specifications at different levels and within their national EHR solutions
- To **define, specify and demonstrate the EEHRxF use cases**:
 - *laboratory results*
 - *medical imaging and reports*
 - *hospital discharge reports*
 - *patient summary for those suffering from rare disease and/or comorbidities*
- To elaborate the **roadmap** for the above-mentioned **use cases for future** uptake on the eHDSI as well as for the additional usage within MS on national, regional or local level
- To **submit the outcomes** and recommendations of X-eHealth regarding EEHRxF deployment to the relevant bodies on **policy, strategic and operational level**
 - e.g. eHealth Network, National Competence Centres for eHealth, eHDSI operators
- To propose a **governance framework** for the sustainable maintenance, evolution and distribution of standardisation and interoperability



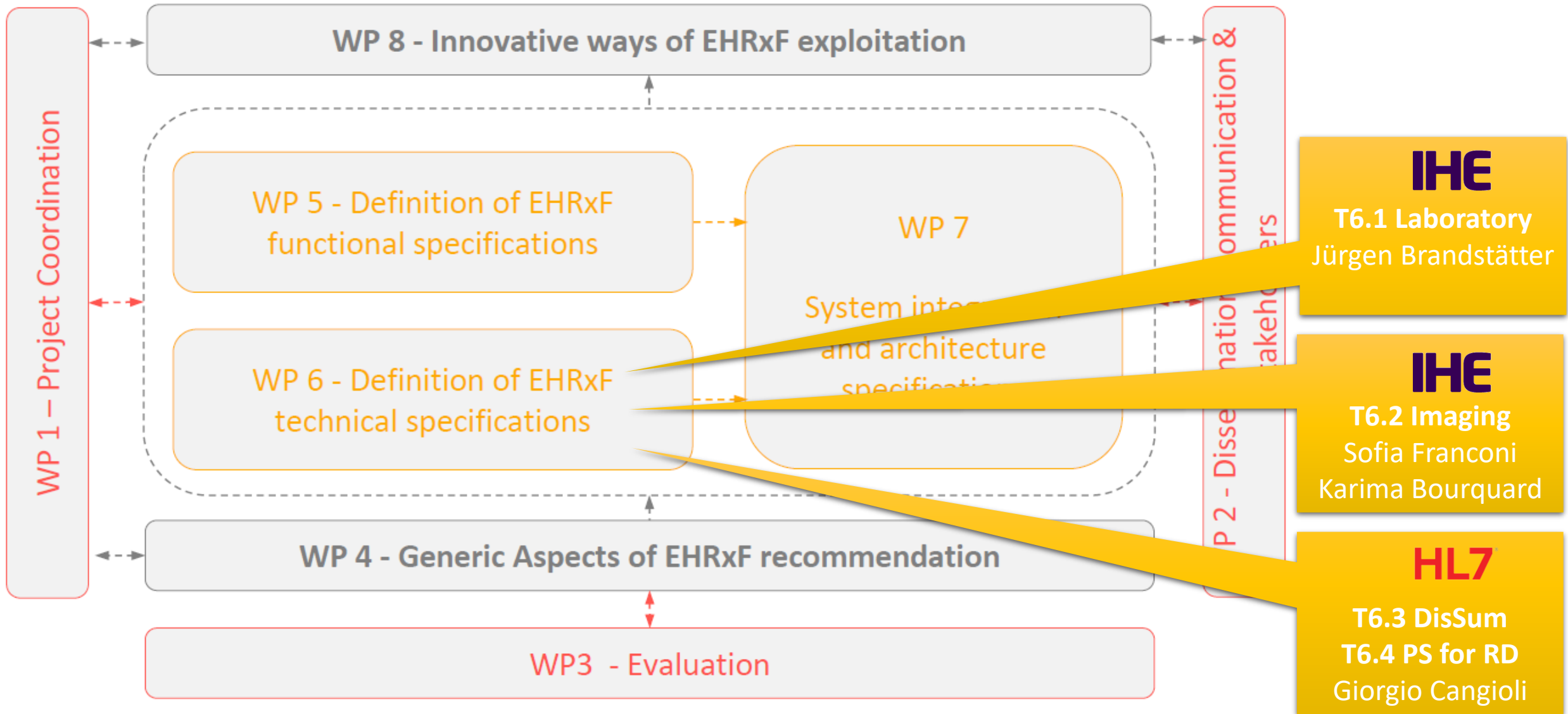
XeH Work packages



XeH Work packages



XeH Work packages



Deliverables

- **D6.1 - X-eHealth Services Specifications.** Service (e.g. transport services) technical specifications for the domain and use cases selected
- **D6.2 - X-eHealth Testing Tools.** A set of testing tools for content and technical specifications that include test scripts
- **D6.3 - X-eHealth Implementation Guide.** Implementation Guide collecting harmonized and updated content technical specifications and associated artefacts initially specified

IHE

IHE

HL7[®]

Outcomes WP6

- **Specifications for ...**

- Laboratory Result Report
- Diagnostic Imaging
- Hospital Discharge Summary
- Patient Summary for rare diseases

CDA: IHE XD-LAB
FHIR: Diagnostic Report Resource

CDA: DICOM PS3.20, IHE MRRT
FHIR: Diagnostic Report Resource

CDA: IPS, EU PS, IHE PCC DisSum, C-CDA DisSum
FHIR: IPS (HL7 + IHE profile), C-CDA on FHIR

- **Specifications in 2 Standards**

- Primary: **CDA**
- Secondary: **FHIR** (if time and budget allows)

CDA: IPS (HL7 + IHE profile), EU PS
FHIR: IPS (HL7 + IHE profile)

- **X-eHealth Tools**

- CDA: Art-Decor
 - <https://art-decor.org/art-decor/decor-project--eehrxf->
- FHIR: GitHub, FHIR IG Publisher
 - <https://build.fhir.org/ig/hl7-eu/x-ehealth/artifacts.html>

**Deferred to
follow-up project**

Laboratory Result Report

Clinical / Business Needs

- Laboratory is an essential domain for diagnostics and clinical decision making.
- Main cross border laboratory use cases:
 - **Laboratory test order**
 - Lab test order could be sent to laboratory in another country (e.g., to referential laboratory)
 - **Sharing laboratory test result report**
 - Lab results could be delivered to ordering party from another country
 - Lab results from country A could be delivered to a point of care in country B on request

Sharing of lab test results is essential for continuity of care in X-border situations

Clinical / Business Needs

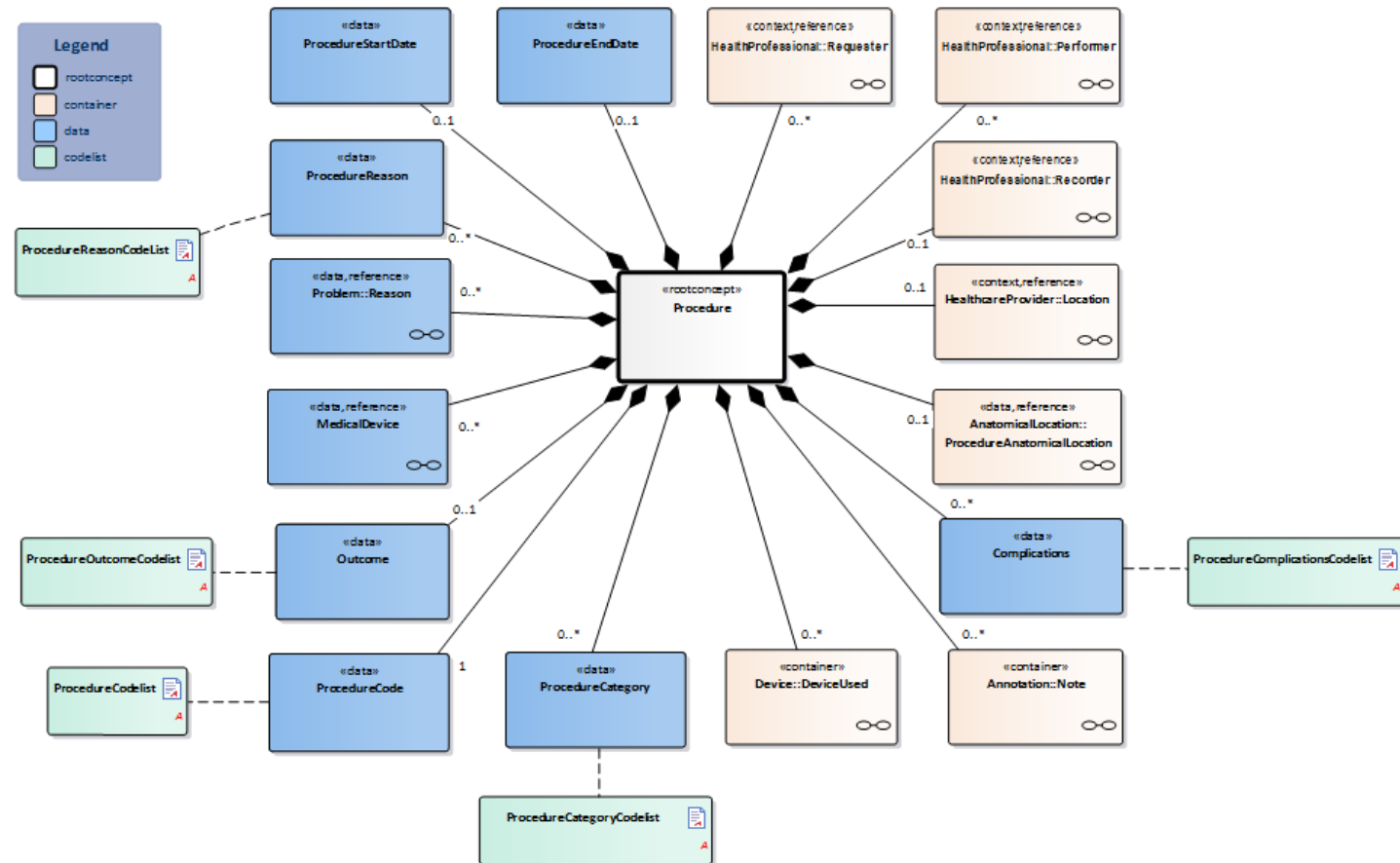
- **Lab functional specifications (T5.3)**

- Include all interoperability layers according to the ReEIF

- **LRR Information Model**

- **Innovations:**

- Harmonization of Terminologies (e.g., Study Types, ...)
- Concept for Search & Filter (Metadata)
- Cooperation and co-creation with Standards Development Organizations



- **Excellent cooperation between IHE and HL7 in WP6**
 - Close and friendly cooperation
 - Common goal: provide best-possible outcome
- **Tight contact with WP5 „Functional requirements“**
 - WP6 tries to hold on functional requirements
 - WP5 acknowledges feedback out of „implementation practice“ and standards
- **Feedback look to SDO community**
 - E.g. Laboratory: Requirements not covered by XD-LAB will not be simply specified, but discussed with IHE PALM

The coding systems

- **Observation codes**

- Nomenclature for properties and units (NPU)
 - IFCC and IUPAC
- Logical observation identifier names and codes (LOINC)
 - Regenstrief institute
- SNOMED CT
 - SNOMED International



Mapping not
trivial

- **Other Code system standardization, e.g.**

- Study Types (e.g. Hematology studies)
- Result values (e.g. negative, positive, bacteria found)
- Specimen types (capillary sample, venous EDTA blood)
- Methods (e.g. POCT or hospital lab method)

Use of conventional test names

Example of conventional test names used for Leukocyte count

B-Leukocyter (sv)

B_Leukocyty (cs)

White blood count (en)

Leukocyte count (en)

WBC (en)

Leukozyten (de)

Λευκοκύτταρα (el)

Might lead to misunderstanding and serious mistakes!

Standard English test names

NPU: B—Leucocytes;num.conc.

LOINC: WBC (Bld) [# /Vol]

Standard test names in local language

(sv) NPU: Leukocyter (B; num. konc. [10⁹/l] *)

(cs) NPU: Leukocyty (B; num. konc. [10⁹/l] *)

(nl) LOINC: leukocyten:aantal/volume

(es) LOINC: Leucocitos:Concentración de número

Might not be understood by physicians trained for conventional test names

Use of conventional test names

Example of conventional test names used for Leukocyte count

B-Leukocyter (sv)

B_Leukocyty (cs)

White blood count (en)

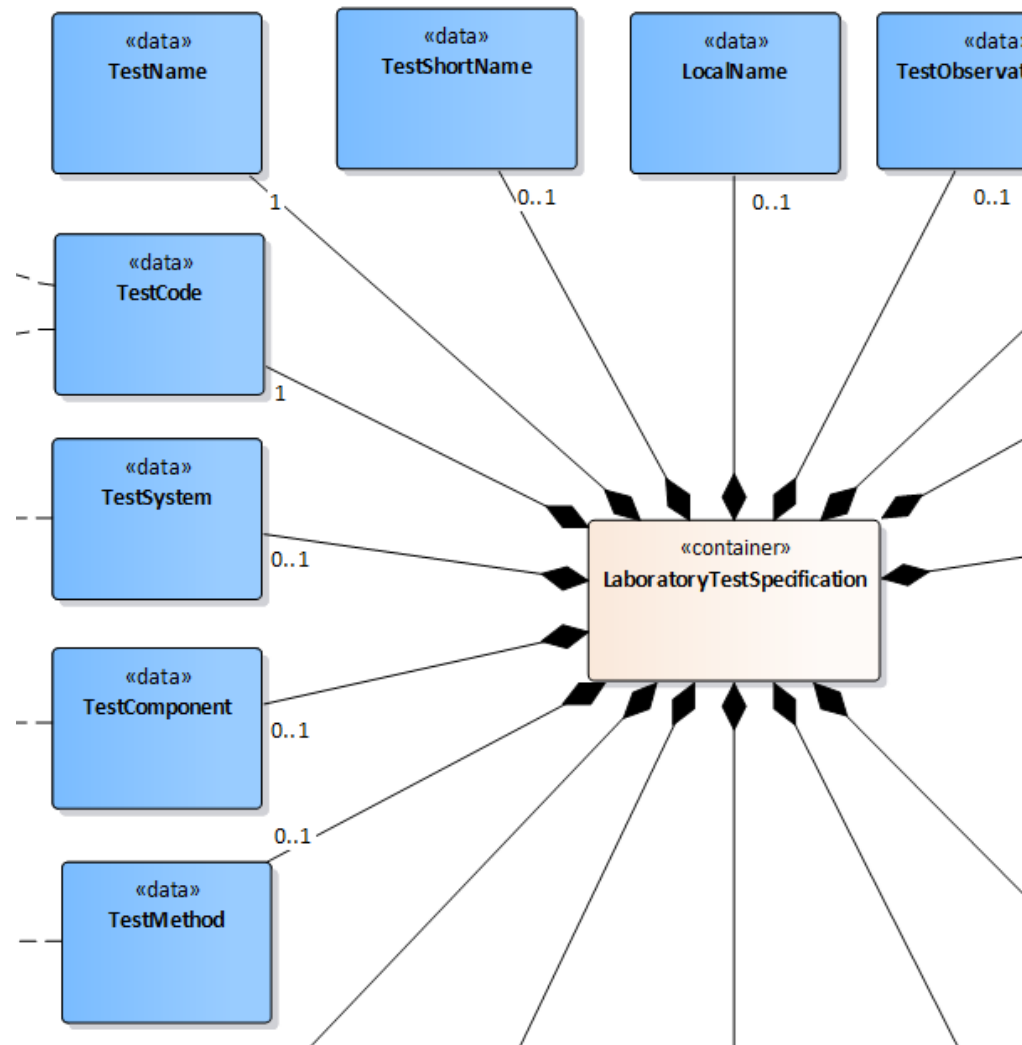
Leukocyte count (en)

WBC (en)

Leukozyten (de)

Λευκοκύτταρα (el)

Might lead to misunderstanding and serious mistakes!



Different result units used for the same test

Example of different units used for Leukocyte count

Leukocyte count = 12.0 * 1000/ μ L

Leukocyte count = 13 x 10⁶/mm³

Leucocyte count = 140 000/mm³

Leucocyte count = 20 x 10⁹/L

Leucocyte count = 25 x 10³(/mm³)

Leucocyte count = 12 000 * 10³/mL

Luecocyte count = 1.2 * 1/nL

Leucocyte count = 18 * 10E9/L

Example of different units used for CRP

CRP = 50 mg/L

CRP = 7 mg/dL

Might lead to serious mistakes!

Different result units used for the same test

Example of different units used for Leukocyte count

Leukocyte count = $12.0 * 1000/\mu\text{L}$

Leukocyte count = $13 * 10^6/\text{mm}^3$

Leucocyte count = $140\ 000/\text{mm}^3$

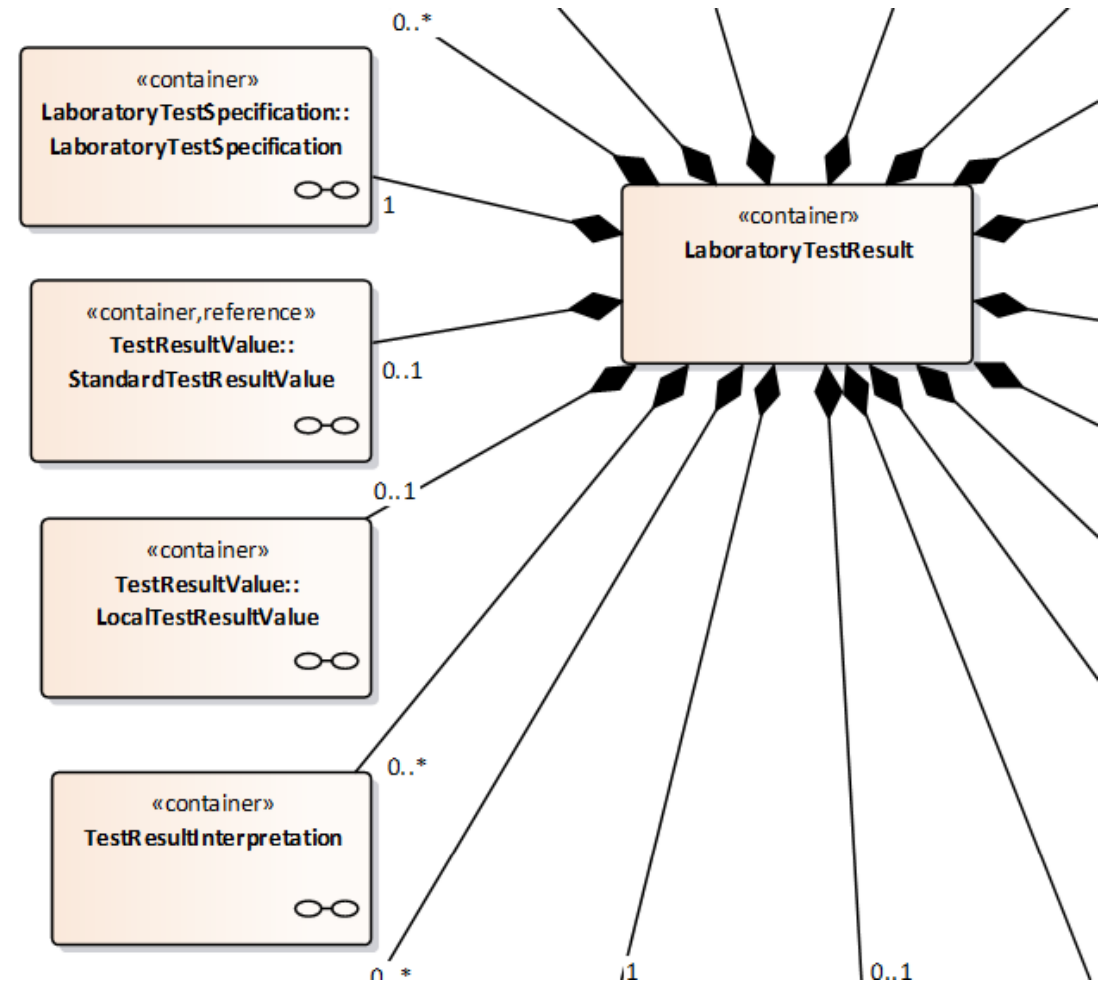
Leucocyte count = $20 * 10^9/\text{L}$

Leucocyte count = $25 * 10^3(/\text{mm}^3)$

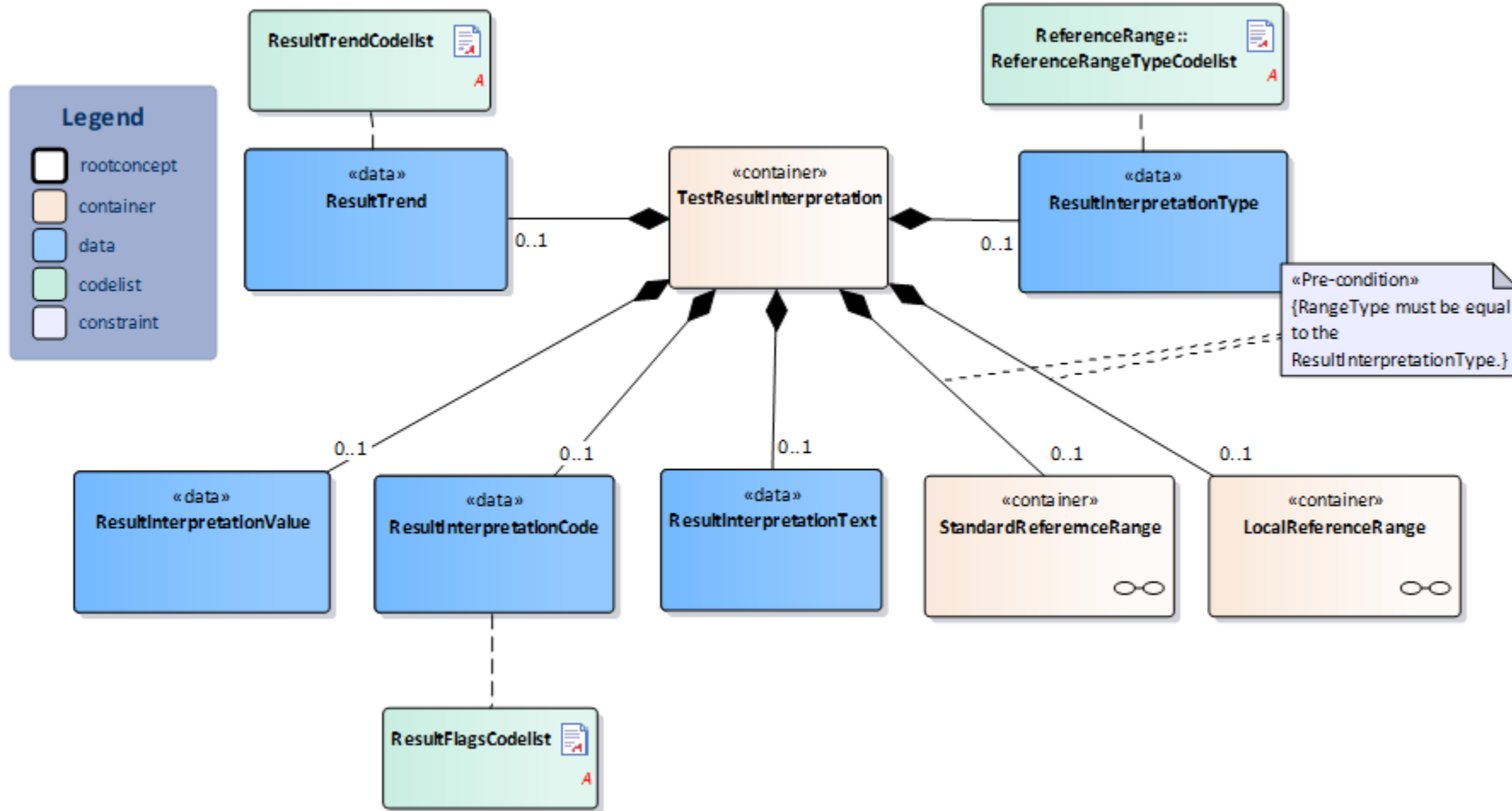
Leucocyte count = $12\ 000 * 10^3/\text{mL}$

Luecocyte count = $1.2 * 1/\text{nL}$

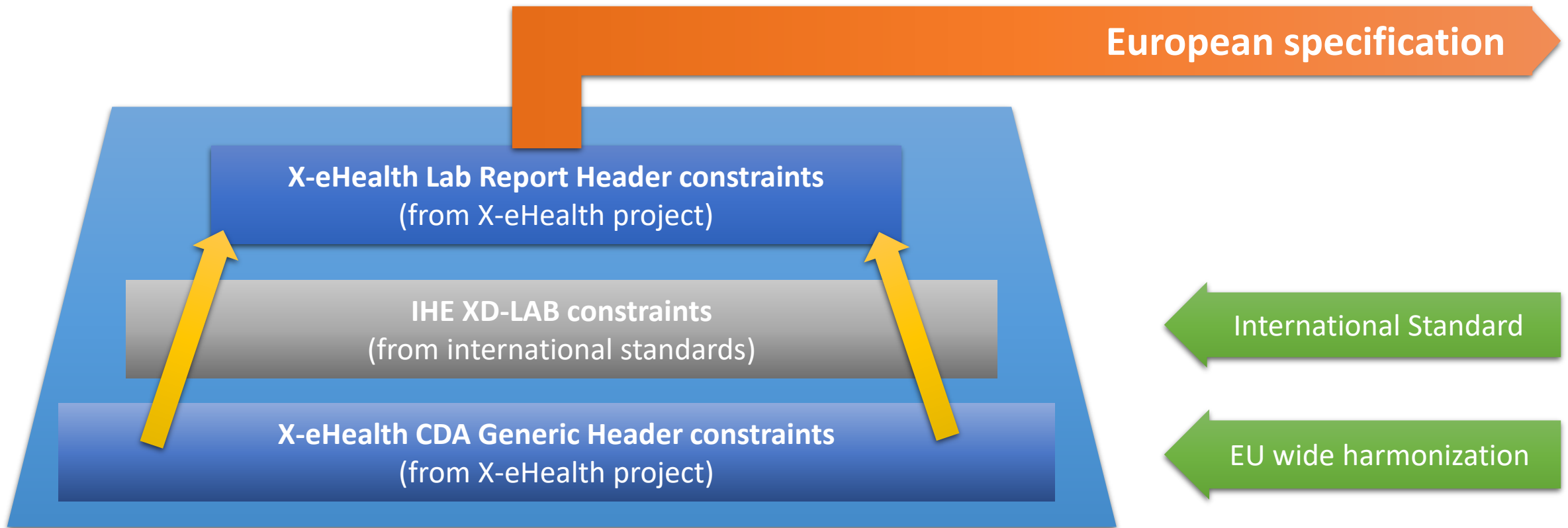
Leucocyte count = $18 * 10\text{E}9/\text{L}$



Result interpretation



Administrative data standardisation



Example of well-formed laboratory report Header



Laboratory of immunology
Center of immunology and mikrobiology

Address tel.: phone no.

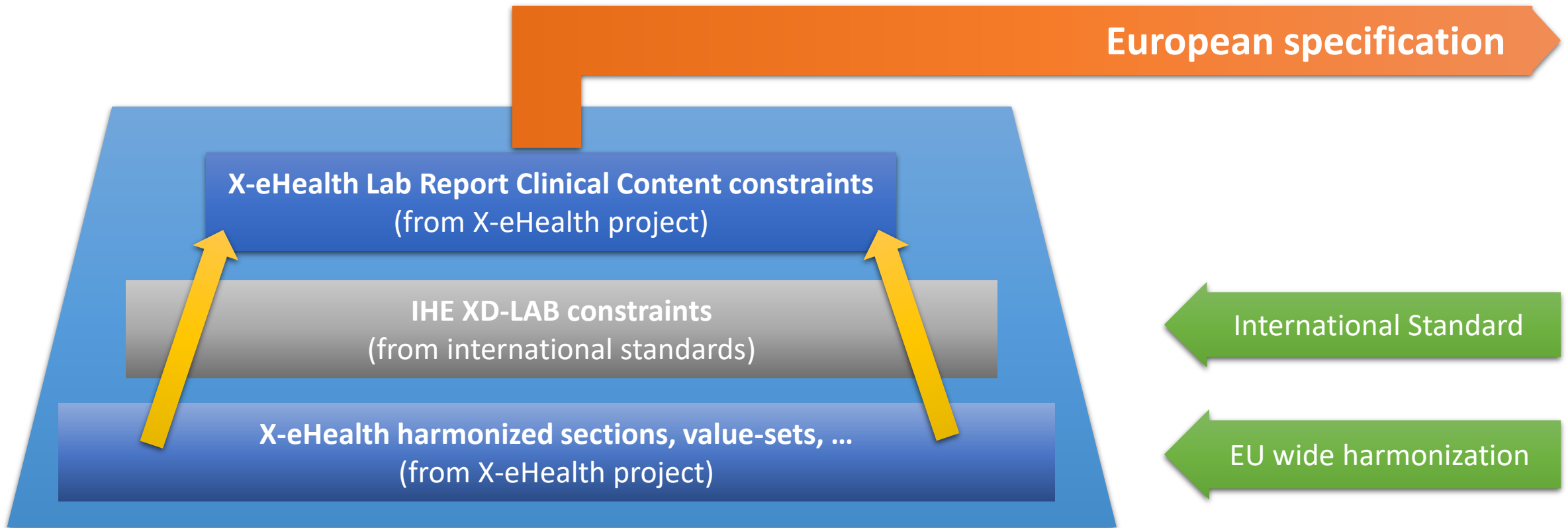
www.page.cz, email: imunology@domain.cz



M 8065

Name:	Patient Name	HCP organization: Sample Hospital, surgical department	
ID:	121212121	HCP name	: John Physician
Age:	96	HCP org. ID	: Specialty: 001
Diagnosis:	A01	HIH No:	111
Received: 4.6.2009 9:19:00		Submitted: 12.6.2009 7:24:00	Printed: 12.6.2009 7:44:36

Clinical lab content standardisation



Example of well-formed laboratory report Body

Test	4.6.2009 7:00	Result graphical assessment	Ref. range	Units
Humoral immunity				
»IgG	10,40	▮ *	7,00 - 16,00	g/l
»IgA	1,17	*	0,70 - 4,00	g/l
»IgM	1,11	*	0,30 - 2,40	g/l
»C-reactive protein	< 3,19	*	< 5,00	mg/l
»C3-complement	1,09	*	0,75 - 1,40	g/l
»C4-complement	0,22	*	0,10 - 0,34	g/l
Infection immunity				
»ASLO	1590	*	0 - 240	IU/ml
»HSV 1+2 IgG	4,60	*	0,00 - 1,00	index
»HSV 1+2 IgM	0,50	*	0,00 - 1,10	index
Anamnestic levels of antibodies against HSV 1+2				
»CMV IgG	57,4	*	< 30,0	AU/ml
»CMV IgM	0,17	*	< 0,50	index
Anamnestic levels of antibodies against CMV				
»EBV-VCA IgM	0,06	*	< 1,05	index
»EBV-EA (D) IgG	0,00	*	< 1,05	index
»EBV-VCA IgG	2,31	*	< 1,05	index
»EBNA-1 IgG	3,30	*	< 1,10	index
EBV comment	anamnestic titter			
Autoimmunity				
»ANA G,A,M	nuclear matrix			
»ANA G,A,M	80	*	0 - 160	titr
Total IgE				
»Total IgE	164,0	*	< 150,0	kU/l

Indication of accredited test

Inline textual interpretation of result

Test group or panel

Test group or panel

Indication of results out of range

Reference range with High value only

Result report end note 2

Result report end note 1

li-13798, Pp-13798

4.6.2009 7:00:00

The result should be evaluated in relation to the patient's medical history and clinical condition.

A list of accredited examinations (») is available on www.imunol-usti.cz
For information on collection procedures, transport conditions and an overview of laboratory tests, refer to the laboratory manual available on www.imunol-usti.cz. It also lists the names of the SOPs for individual accredited examinations in full. Measurement uncertainty is expressed in verification protocols and is available on request.

Results verified by: Name Surname

IHE XD-LAB Profile Clinical Content

One to many „Laboratory Study Type“ section(s):

Laboratory Study Type section
e.g. „HEMATOLOGY STUDIES“

Laboratory Study Type section
e.g. „CYTOLOGY STUDIES“

Lab report - Clinical Document

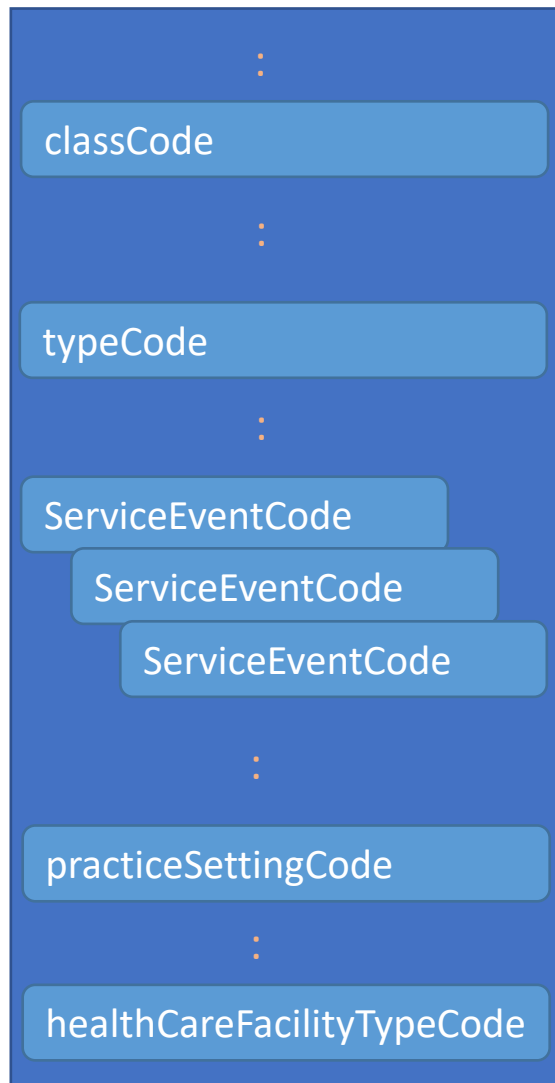
CDA Header

CDA Body

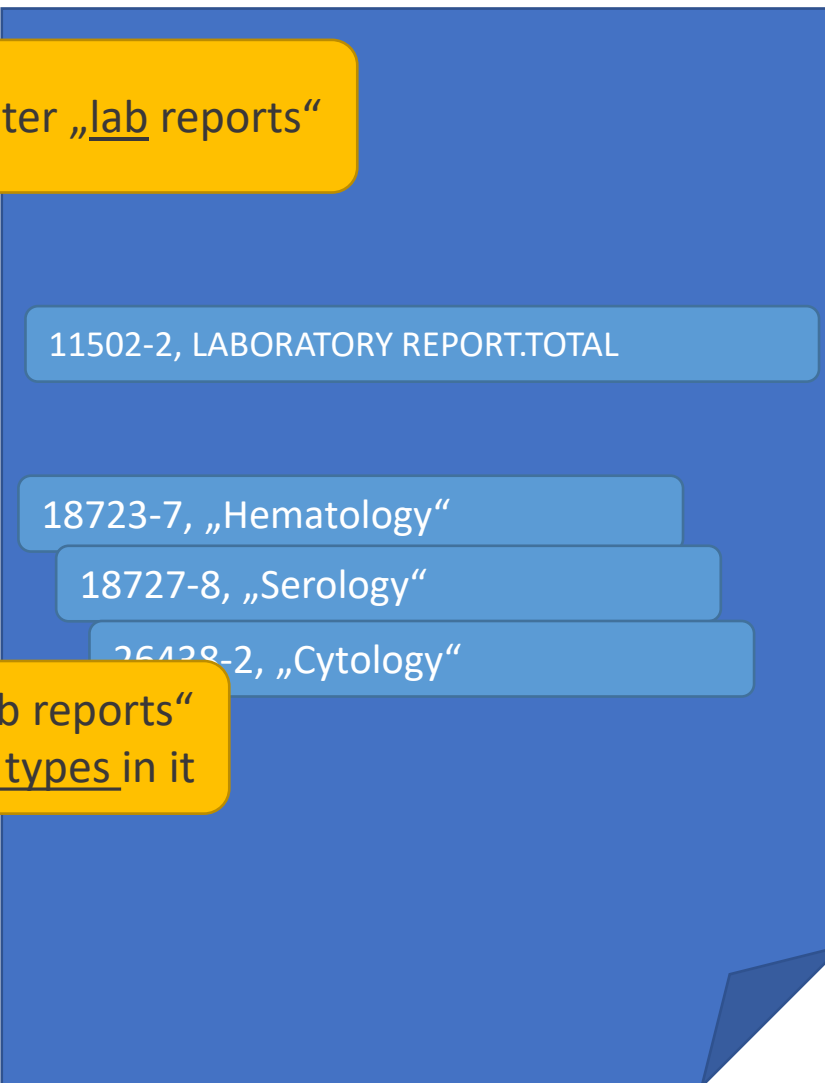


Innovation: The harmonization
and agreement on that list of **Study
Types** is a main outcome

XDS Metadata



CDA document



„Report“



Search & Filter „reports“

Search & Filter „lab reports“

Search & Filter „lab reports“ with certain study types in it

11502-2, LABORATORY REPORT.TOTAL

18723-7, „Hematology“

18727-8, „Serology“

26438-2, „Cytology“

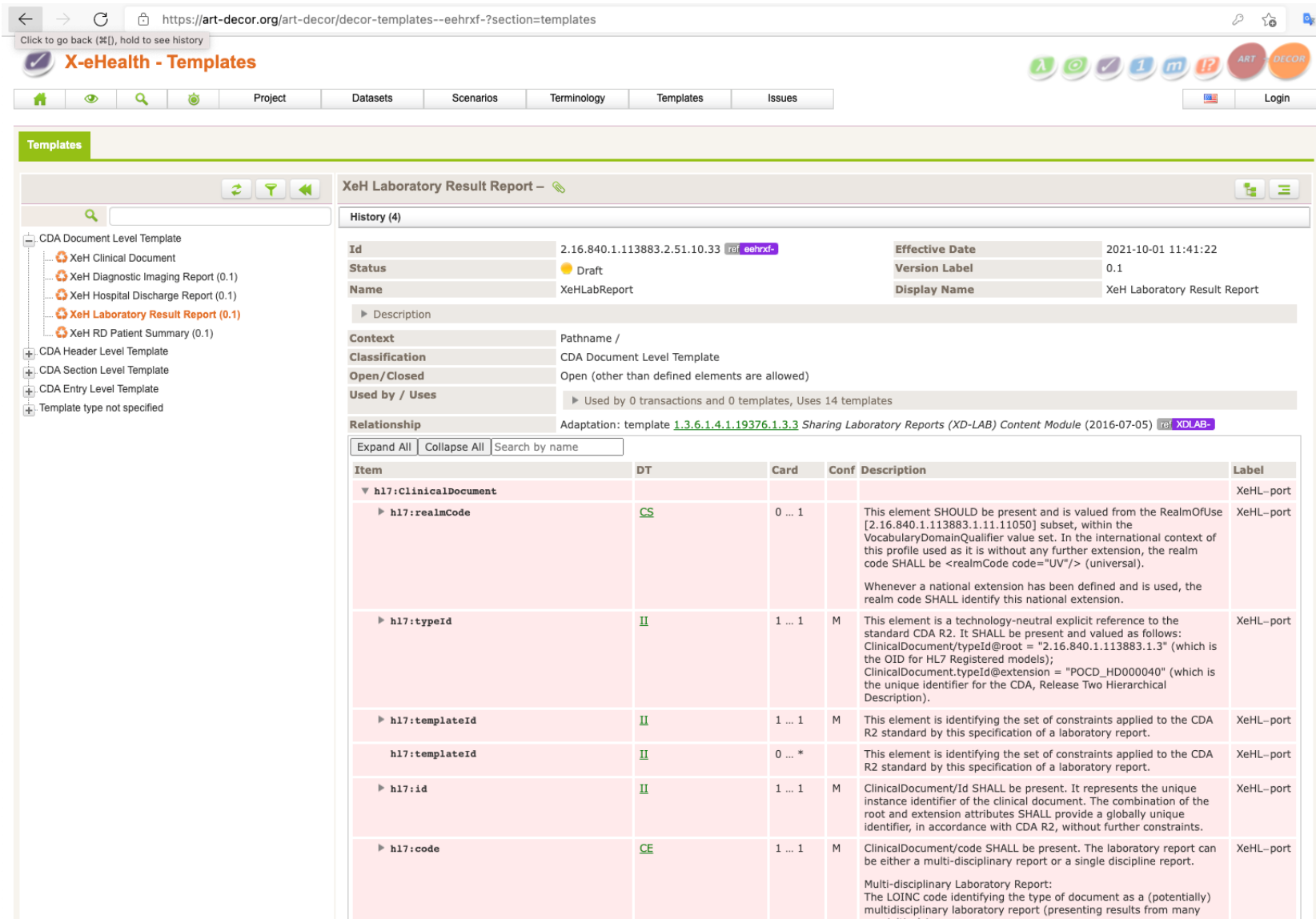
Laboratory specialty
e.g. Multiple Speciality lab,
Biochemistry lab, ...

Under discussion
e.g. Laboratory, Referential Lab, ...

Implementation Guides

Art-Decor based
Publicly available
Free of charge

Link to specifications: [Lab Report IG](#)

The screenshot shows the 'X-eHealth - Templates' web application. The main content area displays the details for the 'XeH Laboratory Result Report' template. The interface includes a navigation menu on the left, a search bar, and a main content area with various sections: History, Metadata, Description, Context, Classification, Open/Closed, Used by / Uses, Relationship, and a table of elements.

History (4)

Id	2.16.840.1.113883.2.51.10.33	Effective Date	2021-10-01 11:41:22
Status	Draft	Version Label	0.1
Name	XeHLabReport	Display Name	XeH Laboratory Result Report

Description

Context: Pathname /

Classification: CDA Document Level Template

Open/Closed: Open (other than defined elements are allowed)

Used by / Uses: Used by 0 transactions and 0 templates, Uses 14 templates

Relationship: Adaptation: template [1.3.6.1.4.1.19376.1.3.3](#) Sharing Laboratory Reports (XD-LAB) Content Module (2016-07-05) [ref: XDLAB](#)

Item	DT	Card	Conf	Description	Label
▼ h17:ClinicalDocument					XeHL-port
▶ h17:realmCode	CS	0 ... 1		This element SHOULD be present and is valued from the RealmOfUse [2.16.840.1.113883.1.11.11050] subset, within the VocabularyDomainQualifier value set. In the international context of this profile used as it is without any further extension, the realm code SHALL be <realmCode code="UV"/> (universal). Whenever a national extension has been defined and is used, the realm code SHALL identify this national extension.	XeHL-port
▶ h17:typeId	II	1 ... 1	M	This element is a technology-neutral explicit reference to the standard CDA R2. It SHALL be present and valued as follows: ClinicalDocument/typeId@root = "2.16.840.1.113883.1.3" (which is the OID for HL7 Registered models); ClinicalDocument.typeId@extension = "POCD_HD000040" (which is the unique identifier for the CDA, Release Two Hierarchical Description).	XeHL-port
▶ h17:templateId	II	1 ... 1	M	This element is identifying the set of constraints applied to the CDA R2 standard by this specification of a laboratory report.	XeHL-port
h17:templateId	II	0 ... *		This element is identifying the set of constraints applied to the CDA R2 standard by this specification of a laboratory report.	XeHL-port
▶ h17:id	II	1 ... 1	M	ClinicalDocument/Id SHALL be present. It represents the unique instance identifier of the clinical document. The combination of the root and extension attributes SHALL provide a globally unique identifier, in accordance with CDA R2, without further constraints.	XeHL-port
▶ h17:code	CE	1 ... 1	M	ClinicalDocument/code SHALL be present. The laboratory report can be either a multi-disciplinary report or a single discipline report. Multi-disciplinary Laboratory Report: The LOINC code identifying the type of document as a (potentially) multidisciplinary laboratory report (presenting results from many specialties).	XeHL-port

Upcoming events



X-EHEALTH
25TH MAY 2022 | 09:00 · 13:00 CET
#2 Professional Training Sessions
DATA EXCHANGE FOR BETTER HEALTH - ACCESSING
AND SHARING MEDICAL IMAGES AND DISCHARGE
LETTERS ACROSS EUROPE

<https://bit.ly/3rOBLbF>



X-EHEALTH
**INTEROPERABILITY
AWARD**
2022

<https://bit.ly/3MxU65U>



X-EHEALTH
7 · 9 JUNE 2022 · ONLINE EVENT
hackathon
FOR CHRONIC DISEASE MANAGEMENT

<https://bit.ly/3vIJO21>

- X-eHealth Website: <http://www.x-ehealth.eu/>
- LinkedIn: <https://www.linkedin.com/company/x-ehealth/>
- Twitter: https://twitter.com/x_ehealth

Thank you



Jürgen Brandstätter

Member, IHE International Board
Executive Board, Global Consortium for eHealth Interoperability
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Co-chair GDC, Education

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CodeWerk Software Services and Development GmbH